

Maximillian Diaz¹, Jianqiao Tian¹, Adolfo Ramirez-Zamora², and Ruogu Fang¹

¹J. Crayton Pruitt Family Department of Biomedical Engineering, University of Florida, Gainesville, FL

²Center for Movement Disorders and Neurorestoration, University of Florida, Gainesville, FL

Introduction

Parkinson Disease (PD) is the second most common neurodegenerative disease

- PD is diagnosed by the presence of resting tremors, muscle stiffness, and slowness
- Symptoms occur late in the disease progression
- PD has been shown to affect eye blood vessels

UKB Data Set

- Images from United Kingdom Biobank (UKB)

UF-UKB Data Set

- Data collected at UF with a Remidio FOP
- UKB used for age-gender balanced images

DATA SETS

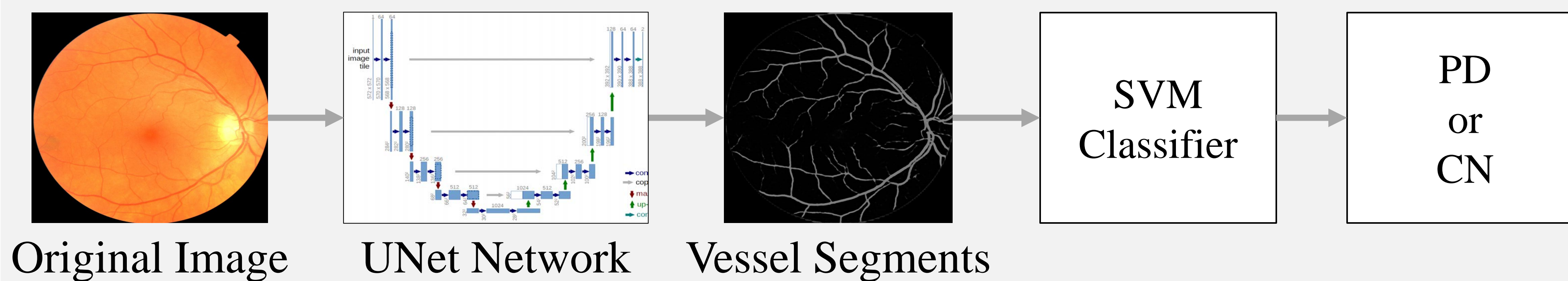
Table 1 | UKB Dataset Demographics

Demographic	Value
Mean Age	60.9
Standard Deviation of Age	6.4
CN Images	238
PD Images	238
Total images	476

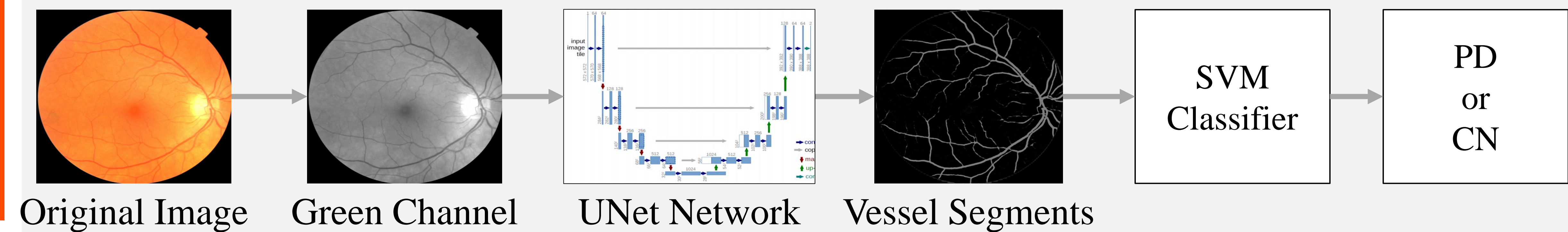
Table 2 | UF-UKB Dataset Demographics

Demographic	UF	UKB	Total
Mean Age	37.6	66.3	44
Standard Deviation of Age	23.5	9.6	22.5
CN Images	28	44	72
PD Images	72	0	72
Total Images	100	44	144

RGB Image Network Flow



Green Channel Image Network Flow



RESULTS

Table 3 | Performances of networks trained on UKB and UKB-Green

Method	Accuracy(%)	Sensitivity(%)	Specificity(%)
UKB Linear	.698	.625	.771
UKB Sigmoid	.698	.750	.646
UKB RBF	.635	.729	.541
UKB-Green Linear	.688	.604	.771
UKB-Green Sigmoid	.719	.792	.646
UKB-Green RBF	.656	.680	.625

Table 4 | Network performances from UF-UKB and UF-UKB-Green

Method	Accuracy (%)	Sensitivity(%)	Specificity(%)
UF-UKB Linear	.821	.786	.857
UF-UKB Sigmoid	.786	.786	.786
UF-UKB RBF	.786	.786	.786
UF-UKB-Green Linear	.857	.786	.929
UF-UKB-Green Sigmoid	.821	.786	.857
UF-UKB-Green RBF	.821	.786	.857

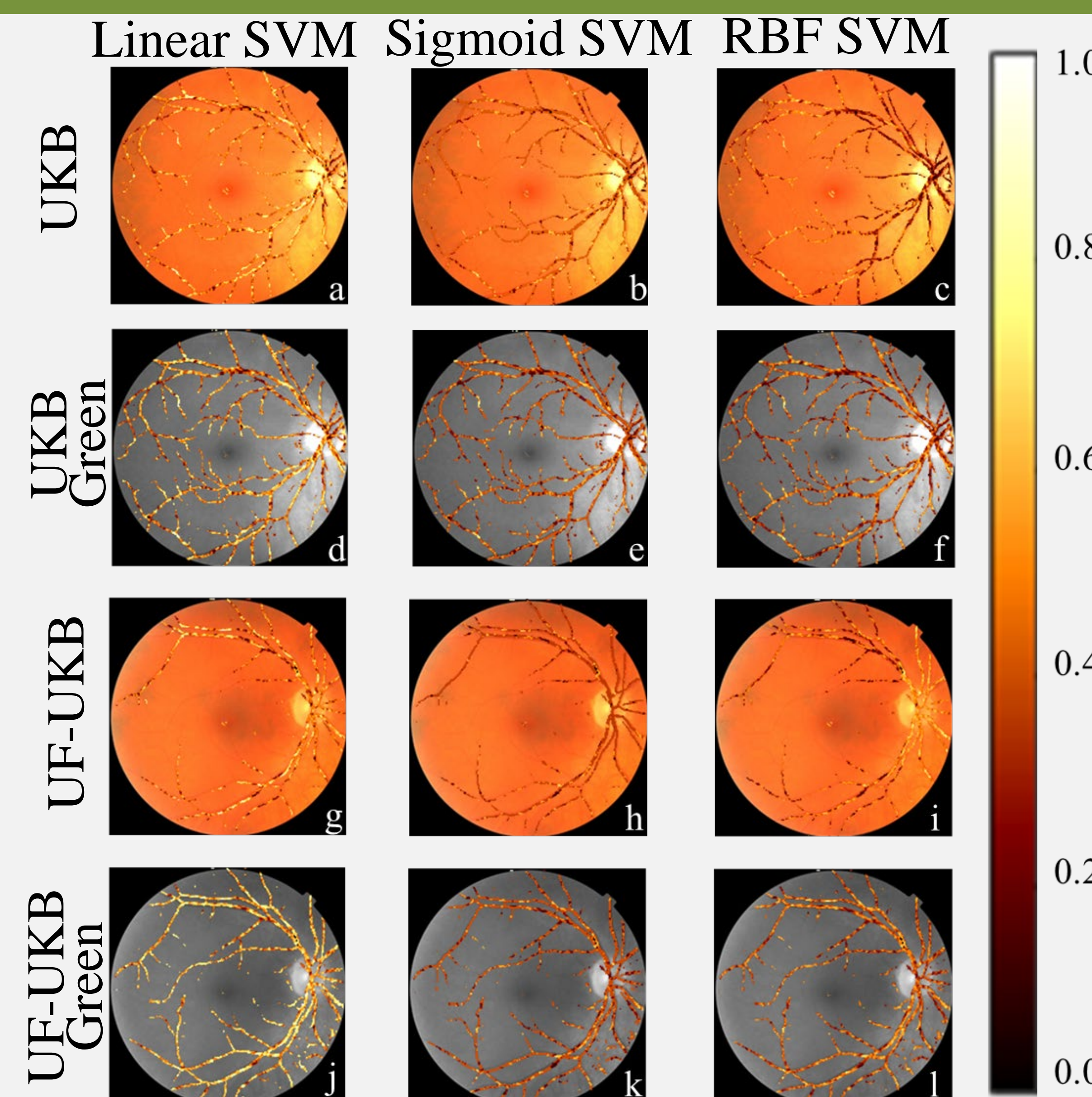


Figure 3 | Saliency maps illustrating the regions of importance determined by the SVM

CONCLUSION

- The results indicate that the proposed machine learning classifies PD based on retina vasculature
- The proposed method shows that the key features are smaller blood vessels
- Machine learning classifiers can be applied to clinically available data and provide accurate predictions
- The proposed methods further supports the idea that changes in brain physiology can be observed in the eye
- The use of single-color channels can improve performance.

REFERENCE

- [1] L. M. de Lau and M. M. Breteler, "Epidemiology of Parkinson's disease," *The Lancet Neurology*, vol. 5, no. 6, pp. 525-535, June 2006.